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SOME NORTH AMERICAN OSMIINAE (HYMENOPTERA, APOIDEA)

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The following paper is based on specimens obtained very largely in California and in Colorado, although other western states—such as Idaho, Arizona, New Mexico, Wyoming, Washington, Texas—as well as North Carolina and Mexico are also represented in the records. The author is indebted to a number of different collectors for material supplied. The names of these collectors are noted in connection with the species reported upon. Practically all the specimens are from the collections of The American Museum of Natural History, of Prof. T. D. A. Cockerell and of the author. I wish to express my special gratitude to Prof. Cockerell for the opportunity of examining his collection, and for many kindnesses extended to me. The holotypes of the new species herein described have been placed in The American Museum of Natural History. Descriptions of certain species mentioned in the keys of this paper have been sent elsewhere for publication.

ASHMEADIELLA

The bees of the genus *Ashmeadiella* are confined to North America, having been reported from British Columbia on the north to Yucatan on the south. They are most abundant and diversified in the dry regions of our southwestern states, where a large proportion of the species are found. About seventeen species have been recorded from California.

Existing descriptions of species of this genus are very poor, too much emphasis having been placed on such characters as the color of the tegulae, and too little on structure and punctation. For this reason many of the species can not be definitely identified from the descriptions. In order to rectify this condition as much as possible, notes are here given on many of the previously described species. With the original descriptions, supplemented by these notes and the keys, it is hoped that the species may be correctly determined.

I have included *Titusella* in the keys, as it is very close to *Ashmeadiella*, the chief characters for its separation being the broad mandibles of *Titusella* and the form of the clypeus, which is variable within *Ashmeadiella*. The lengths of the joints of the labial palpi are hardly

of value in separating these two genera, *Titusella* merely presenting one extreme, as will be seen by the following tabulation:

First joint of labial palpi one and one-half times as long as second.

A. maxima Michener.

First joint of labial palpi but little longer than second.

A. denticulata (Cresson), *A. bigeloviae* (Cockerell), *A. cactorum cactorum* (Cockerell), *A. c. aridula* (Cockerell), *A. timberlakei* Michener.

First joint of labial palpi about equal to second.

A. coloradensis Cockerell, *A. basalis basalis* Michener, *A. californica californica* (Ashmead).

First joint of labial palpi a little shorter than second.

T. cubiceps (Cresson), *T. clypeata* Michener.

Unfortunately, male *Titusella* is unknown.

Ashmeadiella coloradensis Cockerell

This species varies from the brightly colored form described by Cockerell to the entirely black form. A cotype has the red confined to the first two tergites, the legs being entirely black.

FEMALE.—Length 5 to 6½ mm. Facial line a little longer than transfacial; vertex and scutum shiny with moderate-sized, dense punctures[1]; punctures of clypeus, which has a slightly concave truncation at the apex, a very little coarser than those of vertex; abdomen not as closely punctate as in the male, distinctly more finely punctate than the vertex. Pubescence much as in the male but not covering clypeus; the pair of hair tufts on anterior margin of scutum inconspicuous. Legs black, or hind femora and sometimes area on inner sides of hind tibiae red; abdomen black, or first tergite red, the second and third red except in the middle (less red on third than on second).

Boulder, and White Rocks near Boulder, Colorado, July 8, 1935, on *Petalostemon* and *Psoralea tenuiflora* (Cockerell and Michener, collectors); one female, with red, from Aliso Canyon, Los Angeles County, California, May 3, 1931 (Michener). The latter record is very interesting, as Aliso Canyon is on the north side of the San Gabriel Mountains in desert country. The Californian specimen seems a little more finely punctate than Colorado specimens, and the discovery of Californian males may show that it is a distinct species.

The median apical teeth of the male abdomen are variable. They may be triangular as in the types or similar to those of *A. denticulata* (Cresson). The female is difficult to distinguish from *A. cactorum* (Cockerell) without specimens for comparison, but the male is easily separated by the short apical teeth of the abdomen. *A. coloradensis* is more finely punctate than *A. cactorum*, but the differences are difficult

[1] Vertex of male punctured as in the female, but scutum more sparsely punctate.

to indicate in a key, and *A. coloradensis* is unusually variable, so that some individuals show but little difference in punctation from *cactorum*. Considering the variability of both sexes of *A. coloradensis*, I think it probable that there are two species. However, since the male genitalia are the same, I do not wish to separate a new form now.

Ashmeadiella howardi Cockerell

Figure 1

FEMALE.—Apex of clypeus broadly rounded, minutely crenulate, the margin "very broadly somewhat shining." "Vertex more densely punctured than mesothorax or scutellum, but not more coarsely." (Cockerell, in litt., 1935, notes from type.)

MALE.—Tegulae vary from nearly black to reddish; red of abdomen sometimes extending back at extreme sides to fifth segment. Median teeth at apex of abdomen rather slender, not much widened at bases, somewhat parallel-sided, sometimes black; lateral teeth at apex of abdomen broad, making the lateral margins to sixth tergite convex, after the manner of *A. timberlakei* Michener.

Two males which agree with Cockerell's original male are from Eagle Rock Hills, Los Angeles County, California, April 14, 1932, on *Rhamnus crocea* (Michener, coll.). The female is distinguished from all other species by the form of the clypeus.

Ashmeadiella submaxima, new species

MALE.—Length nearly 8 to 9 mm. Similar in general appearance and in structure to *A. maxima* Michener, differing as follows: head not quite so wide; punctures of vertex a very little coarser, but scutum rather dull, its punctures considerably finer; punctures of abdomen sparser, those of middle of second tergite separated by more than their diameters; median teeth at apex of abdomen very slightly longer; anterior margin of scutum without a pair of hair spots; claw joints of tarsi ferruginous.

Two from Walsenburg, Colorado, June 14, 1919, about 37° 37′ N., 104° 47′ W., and about 6200 feet altitude (F. E. Lutz).

The apex of abdomen is almost exactly like that of *A. californica* (Ashmead).

Ashmeadiella arizonensis, new species

MALE.—Length nearly 7 mm.; black; flagellum brown beneath; mandibles with a bright red transverse band; legs very dark brown, the apical joints of tarsi reddish; tegulae with a brown spot; extreme sides of tergites and posterior margins of first few tergites dark brown. Inner orbits hardly converging below, their lower ends slightly diverging; facial line a little shorter than transfacial; clypeus shining, rather coarsely but not densely punctured; rest of head and thorax densely punctured, the vertex shining with moderate-sized punctures, the scutum dullish with quite small punctures; pleura punctured more like the vertex; abdomen with moderate-sized punctures, larger than those of scutum, well separated on dorsum of first few tergites,

closer on posterior and lateral parts of abdomen; median teeth at apex of abdomen quite long, though not twice as long as basal width; lateral teeth shorter but fairly slender. Pubescence white, abundant on sides of face, around antennae, under apical margin of clypeus, on pleura (especially the edges), on scutellum, and on anterior edge and sides of scutum; first to fourth tergites with narrow hair bands, that of first tergite widened at sides; no pair of hair tufts at anterior edge of scutum. Wings clear.

Kits Peak, Rincon Baboquivari Mountains, Arizona, August 1–4, 1916 (one specimen).

Related to *A. submaxima* Michener, which has different coloration, more abundant pubescence, and slightly finer punctures on abdomen. *A. opuntiae* (Cockerell) is related, but has a longer head, has finer punctures on first two tergites, and is differently colored, having black legs. In general appearance, *A. arizonensis* is more slender than *A. maxima* Michener and *A. submaxima* Michener, but more robust than *A. opuntiae* (Cockerell), and smaller than any of these. *A. arizonensis* resembles *A. opuntiae* and differs from its other relatives by the coarsely punctured clypeus.

Ashmeadiella opuntiae (Cockerell)

A male from Palm Springs, California, March 24, 1935 (W. P. Cockerell) was determined by Timberlake as *opuntiae*.

MALE.—Length about 7 mm. Face nearly covered with white pubescence; pleura rather copiously hairy. Mandibles and antennae black. Vertex and scutum shining, with rather close punctures, those of vertex moderate-sized, those of scutum rather small; abdomen with rather fine, fairly close, punctures, those of first tergite larger than those of second; teeth at apex of abdomen black, the median ones long, parallel-sided, subtruncate at apex, somewhat widened at base, not quite twice as long as basal width. Wings very faintly grayish.

Probably most closely related to *A. arizonensis* Michener, which it resembles in the coarsely punctured clypeus.

Ashmeadiella bucconis (Say)

A female from Fedor, Texas, and a male from Durant, Oklahoma, June 2, 1905, on *Verbesina helianthoides* (C. R. Jones, coll.) are referred to this species. They agree with Robertson's description. The female differs from *A. denticulata* (Cresson) by the coarser punctures throughout, especially on the cheeks, and by the darker scopa. In the male the differences of punctation are evident, but not quite so conspicuous. The wings of *A. bucconis* are darker than in *A. denticulata*. In this and the next species the vertex and cheeks are prolonged farther behind the eyes than in any other forms.

Ashmeadiella denticulata (Cresson)

Figure 2

Specimens from California and Texas average somewhat smaller than those from New Mexico. Also, the heads of small specimens are somewhat less extended behind the eyes. However, it appears that there is but one species involved.

Mr. P. H. Timberlake has seen the type of *A. wislizeni* Cockerell and states that it is surely the same as *A. denticulata.* No doubt *A. rotundiceps* (Cresson) is the female of *A. denticulata. A. osmoides* (Cresson), originally described as a *Megachile,* is probably either *A. denticulata* or *A. bucconis.* If it is found to be *denticulata,* this species will have to be called *A. osmoides.* It may be that *A. denticulata* should be considered a western subspecies of *A. bucconis.*

California: Eagle Rock Hills and Altadena, both in Los Angeles County; San Jacinto; Corona; Murrieta; Rathbon Creek, San Bernardino Mountains; Oro Grande, Mojave Desert; dates from June 22 to September 14, on *Aster, Croton californicus, Senecio douglasii,* and *Isocoma veneta* var. (Michener, coll.). Riverside, dates from August 21 to September 28, on *Gutierrezia sarothrae* (Timberlake, coll.). Cajon Valley, July 2 (Cockerell).

Arizona: Oak Creek Canyon, elevation 6000 feet, August (F. H. Snow).

New Mexico: Las Vegas, August, on *Verbesina enceloides* and *Solidago canadensis* (W. Porter, coll.).

Colorado: Boulder, August (S. A. Rohwer), and July 8, 1935 (Michener); Livermore, August 17, 1903.

Texas: Devils River, May 6, 1907, on *Ratibida columnaris* and *Maribaundium origanifolium* (F. C. Bishopp, coll.).

Ashmeadiella coquilletti Titus

A female from Auburn, Placer County, California, July 8, 1929, collected from red cedar slabs (Calif. Dept. Agr. No. 29318) has been identified as this species by Sandhouse. Presumably it was compared with the type.

FEMALE.—Length 6½ mm. Similar to *A. californica* (Ashmead) but clypeus duller, with punctures only a little larger than those of vertex; punctures of scutum a little coarser than in *californica* and a little coarser and sparser than those of vertex; punctures of abdomen distinctly coarser and closer than in *californica.* Pubescence not as ochraceous as described by Titus. Mandibles with a reddish band close to apex; tegulae largely reddish. Wings faintly grayish.

Ashmeadiella echinocerei Cockerell

The following notes are on a specimen from Puerto Refugio, Gulf of California. I have not seen specimens from the type locality.

FEMALE.—Similar to *A. cactorum* (Cockerell) but smaller and less slender; punctation of vertex and scutum quite fine and very dense, these parts shining only slightly; punctures within ocellar triangle coarser than elsewhere on top of head; pleura more sparsely punctate than scutum; abdomen more finely punctate than in *A. cactorum*, its punctures hardly finer than those of scutum.

The name *A. echinocacti* Cockerell (Ann. Mag. Nat. Hist., 1931) is a slip for *echinocerei*.

Ashmeadiella leucozona Cockerell

I have examined a cotype of each sex.

MALE.—Vertex more finely and closely punctate than scutum, both shiny, especially the latter; abdomen with rather small, not very close, punctures, finer than those of vertex; lateral teeth at apex of abdomen pointed; median teeth about as broad as long (not twice as broad as long[1]).

FEMALE.—Clypeus truncate at apex, as usual in the genus; scutum and vertex contrasting as in the male; abdomen punctured as in the male.

Ashmeadiella basalis basalis, new subspecies

MALE (type).—Length 5 to 5½ mm. Facial line longer than transfacial; eyes converging below except at extreme lower ends; mandibles and antennae black. tegulae testaceous; head slightly shining with rather small, rather dense punctures; Scutum with smaller, denser punctures; pleura with sparser punctures. Wings clear. Legs black, the basal third of hind femora red (hardly so in one specimen). Abdomen with rather small, not dense, punctures, finer in center of third tergite than in center of second; first tergite red except for a black area on dorsum; second tergite red at extreme sides (in one specimen there is also some brownish red at sides of some of the other tergites); apex of abdomen with the usual four teeth, the lateral ones red or black, acutely pointed, the median ones rather variable in shape, longer than basal width, in one specimen nearly twice as long as basal width. Pubescence not abundant, dull pale ochraceous on face, vertex, and dorsum of thorax, elsewhere nearly white; pubescence fairly abundant on face but not obscuring surface except laterally; front of scutum with two poorly defined hair spots; abdomen with narrow bands on first to fifth tergites.

FEMALE.—Length 5 to 6 mm. Facial line longer than transfacial; eyes converging below; mandibles and antennae black; clypeus truncated, the truncation a little concave; anterior third of clypeus very dull and finely punctate, without the usual narrow, more or less shining, margin; rest of face slightly shining, with moderate-sized close punctures; vertex more strongly shining, with larger, less close, punctures. Scutum dullish, with fine close punctures, strongly contrasting with the vertex; tegulae dark testaceous; pleura slightly more coarsely punctured than scutum. Legs black, the basal two-thirds or three-fourths of hind femora red. Abdomen black, the sides of first three tergites and sometimes entire first tergite red; dorsum of first

[1] Possibly this is the "variety a" but it is not so marked.

few tergites with punctures a little smaller and considerably sparser than those of scutum; posterior tergites and sides of anterior ones more coarsely and closely punctate. Pubescence white, slightly ochraceous on dorsum of head and thorax, a little less abundant than in the male.

California: Altadena (type locality), on dates from April 8 to August 2 (Michener); Florence Lake, Fresno County, July, 1932 (Michener); Mountain Home Creek, San Bernardino Mountains, elevation 5000 feet, August 15, 1934 (Timberlake). Flower records are *Lotus scoparius*, *Senecio douglasii*, and *Pentstemon ternatus*. I am indebted to Mr. Timberlake for the female of this species.

The dull and finely punctate anterior margin of the clypeus distinguishes the female from all other species. The male is rather easily recognized by the arrangement of red on the abdomen and hind legs. (See additional characteristics given in the key to the species.)

Ashmeadiella basalis nigra, new subspecies

MALE AND FEMALE.—Similar to typical *A. basalis*, but legs and abdomen without red; tegulae black or nearly so. The female is the type.

Boulder, Colorado (type locality), July, 1935 (Michener), May 26, 1908 (Rohwer); Las Vegas, New Mexico, August 4, on *Convovulus arvensis* (W. Porter, coll.).

The male of this form has been considered the male of *A. prosopidis* (Cockerell), but I collected females at Boulder which show that it is not related to the true *A. prosopidis* from southern New Mexico. True *A. prosopidis* does not show a distinct difference between the punctation of the vertex and that of the scutum.

My Boulder specimens were collected around a pile of small dead logs and branches of trees, where they were probably nesting, and were called to my attention by Dr. C. H. Hicks.

Ashmeadiella curriei Titus

A male from Olympia, Washington, July 1, 1896 [previously recorded by Cockerell as *A. prosopidis* (Cockerell)] is, no doubt, the male of *curriei*.

Length about 5 mm. Facial line longer than transfacial; pubescence of face rather sparse for a male, not obscuring surface except on sides; mandibles and antennae black; vertex and scutum rather dull, with small close punctures, those of vertex a little coarser than those of front or scutum; tegulae black anteriorly, faintly reddish posteriorly. Wings slightly dusky. Abdomen finely and quite closely punctured; teeth at apex of abdomen short, the lateral ones broad and pointed, the median ones rounded, not as long as width at base; extreme sides of tergites brownish. Pubescence rather sparse, white, slightly ochraceous in most lights around antennae, on clypeus, and on scutellum.

Ashmeadiella prosopidis (Cockerell)

A female from Mesilla Park, New Mexico (Cockerell), is undoubtedly true *A. prosopidis.*

Facial line considerably longer than transfacial; apex of clypeus truncated as usual in the genus. Punctures of vertex and scutum moderately large, punctures of abdomen conspicuously finer than those of thorax, especially on dorsum of first three tergites.

Specimens recorded from Las Vegas, New Mexico, and Boulder, Colorado, are *A. basalis nigra* Michener, while the record for Olympia, Washington, refers to *A. curriei* Titus.

Ashmeadiella schwarzi Titus

The following notes are on a specimen from Guaymas, Mexico, previously recorded as *A. schwarzi.*

FEMALE.—Facial line about as long as transfacial; vertex and scutum shining, closely and rather finely punctured; abdomen punctured very similarly, a little more finely so on dorsum of first three tergites. Wings clear. Scopa grayish white; pleura margined with pale hairs; anterior margin of scutum with two confluent hair spots.

The punctation of thorax dorsally is not more separate than elsewhere, and the clypeus is not densely covered with hair, as noted by Titus. Perhaps the Mexican specimens represent a species distinct from the Arizona *schwarzi.*

Ashmeadiella cactorum cactorum (Cockerell)

There are four specimens in the Cockerell collection, some of which have been recorded as the female of *A. meliloti* (Cockerell). I believe that the differences between *cactorum* and *meliloti* are sexual, the recorded female *meliloti* being *cactorum.* Note how close both sexes come in the keys to *A. cactorum aridula* (Cockerell).

FEMALE.—Length 6 to 7½ mm.; slender. Facial line a little longer than transfacial; clypeus truncate at apex, the truncation slightly concave; punctures of clypeus considerably larger than elsewhere; vertex, scutum, and pleura rather shining, with moderate-sized or rather large close punctures; punctures of abdomen moderate-sized, smaller than those of thorax, separated by less than their diameters even on dorsum of first three tergites. Tegulae black or piceous. Anterior margin of scutum with two conspicuous spots of hair; scutellum with copious pubescence.

New Mexico: La Cueva, Organ Mountains, September 8, on *Phacelia congesta* (Townsend, coll.); Mesilla, June 24 (Cockerell). Arizona: White River, White Mountains, June 14, 1934 (M. and H. James).

MALE (*A. meliloti*).—Length 5½ mm. Vertex and scutum rather shiny, with moderate-sized, close, punctures, those of scutum better separated than those of

vertex; punctures of abdomen nearly as coarse as those of dorsum of thorax, though not so close; lateral teeth at apex of abdomen nearly as long as basal width; median teeth quite long, though not twice as long as basal width, and rather slender.

New Mexico: Albuquerque, June 2, 1911. Arizona: Congress (Oslar).

Specimens reported as *A. cactorum* from Florissant, Colorado, are *A. californica florissantensis* (Michener).

Ashmeadiella cactorum aridula (Cockerell)

Figures 3 and 4

MALE.—Length $4^1/_2$ to $5^1/_2$ mm. Antennae nearly black, or flagellum dusky red, beneath; facial line about as long as transfacial; entire face covered with pale hair, but that on clypeus and sides of face most conspicuous. Vertex and scutum shiny with moderate-sized punctures, fairly close on vertex, a little more distinctly separated on scutum; punctures of abdomen about the same size, finer on dorsum of first two or three tergites. Tegulae usually testaceous, but sometimes piceous or even black. Apical teeth of abdomen black, the lateral ones slender and pointed, the median ones nearly twice as long as basal width, somewhat variable.

FEMALE.—Similar to male; facial line longer than transfacial; pubescence of face not so dense, most conspicuous on sides of face; anterior margin of clypeus truncate. Punctures of scutum rather coarse, somewhat better separated than those of vertex; punctures of dorsum of second and third tergites a little smaller than those of vertex, well separated.

California: Altadena, San Gabriel Canyon, Crystal Lake, all in Los Angeles County; Murrieta; Idyllwild, San Jacinto Mountains. Dates for the above localities range from May 13 to August 16. Flower records are as follows: *Heliotropium curassavicum*, *Aster*, *Eriogonum fasciculatum*, and *Lotus* (all Michener, coll.). Herkey Creek (San Jacinto Mountains), California, June 24, on *Lotus* (Cockerell).

In one male the median apical teeth of the abdomen are much shorter than usual. I believe this is an abnormal specimen, because the two teeth are themselves of different lengths and differently shaped,

This form is distinguished from *A. cactorum cactorum* in the female by the less shiny and more finely punctate upper part of the clypeus, smaller size, usually paler tegulae, more coarsely punctate center of scutum, and reduced hair spots at anterior edge of scutum. The males are usually distinguishable by the average size and color of the tegulae.

Ashmeadiella floridana (Robertson)

Two males and a female of this species are from Southern Pines, North Carolina, June 29, 1918 (the female in pink pulse). The female agrees with Robertson's description except that the head is not as large as one would imagine, and the hair between antennae, on clypeus, and

on scutellum, and the scopa are somewhat yellowish. The appearance is similar to *Alcidamea producta* Cresson as stated by Robertson.

FEMALE.—Facial line somewhat shorter than transfacial; under side of flagellum somewhat brownish; clypeus somewhat shining, with rather large close punctures; supraclypeal area dull and finely punctate in contrast to clypeus and front; punctures of vertex and scutum about the same size, fairly large; punctures of dorsal middle of second tergite considerably finer and sparser than those of dorsum of thorax.

MALE.—Similar to female; pubescence more abundant, but clypeus without much hair; clypeus duller, its punctures finer and closer; punctures of vertex somewhat coarser than those of scutum; punctures of dorsum of abdomen only a little finer than those of scutum; median apical teeth of abdomen subtruncate, broad, not very much longer than basal width.

In both sexes the dull supraclypeal area is distinctive, though it is sometimes difficult to see because of the pubescence.

Ashmeadiella californica californica (Ashmead)

FEMALE.—Length 5 to nearly 7 mm. Facial line slightly longer than transfacial; eyes nearly parallel within; clypeus truncate as usual in the genus; vertex and scutum somewhat shining, with moderate-sized punctures, which are close on vertex, somewhat sparser and larger in center of scutum; front duller, with very close punctures; clypeus with coarser, somewhat elongated, close punctures; abdomen with fine and rather sparse punctures on dorsal parts of first three tergites, those of third tergite coarser than those of second; tegulae black.

MALE.—Length nearly 5 to $6^1/_2$ mm. Face mostly covered with pubescence; punctures of vertex and scutum about the same size, but those of scutum sparser; punctures of sides and posterior parts of abdomen not so coarse as in the female; lateral teeth at apex of abdomen rather broad and pointed; median teeth long, considerably widened basally, nearly twice as long as basal width. (Apex of abdomen similar to that of *A. haematopoda* Cockerell, but lateral teeth somewhat broader and median teeth broader at bases.)

This species, particularly in the female, is quite variable, some specimens being robust with large heads, others comparatively slender. The pubescence is sometimes bright ochraceous, but in other specimens it shows only a faint yellowish tint. However, I am quite certain that there is only one species concerned.

California: Eagle Rock Hills, Altadena, Pasadena, all in Los Angeles County; Mineral King, Tulare County; Tokopah Valley, Sequoia National Park; Murrieta; Mill Creek, San Bernardino Mountains. Dates range from April 14 to September 13. Flower records are *Rhamnus crocea*, *Septhanomeria*, and two species of *Aster*. (All the above were collected by the author.) Santa Clara County, July 11 (W. M. Giffard). Niles Canyon, July 16 (W. M. Giffard). Placer County, 6600 feet elevation, August 24, 1916 (W. M. Giffard). Encinitas, June 28 (Cockerell).

Ashmeadiella californica florissantensis (Michener)

This form is best considered a subspecies of *californica.* I have seen no Colorado specimens as large as some California specimens, nor have I seen any showing the strongly ochraceous pubescence of many California examples. The best subspecific characters are found in the female (see key). An additional locality is Pingree Park, Larimer County, Colorado, August 22, 1935 (Michener).

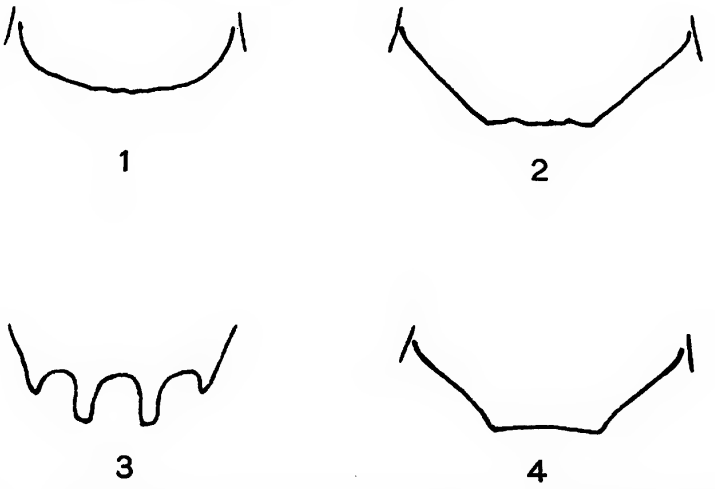

Fig. 1. *Ashmeadiella howardi* (Cockerell), apex of clypeus of female (drawn from the type).

Fig. 2. *Ashmeadiella denticulata* (Cresson), apex of clypeus of female.

Fig. 3. *Ashmeadiella cactorum aridula* (Cockerell), apex of abdomen of male.

Fig. 4. *Ashmeadiella cactorum aridula* (Cockerell), apex of clypeus of female.

Keys to the Species of *Ashmeadiella*

In these keys it has not been possible to include all the described species, but all the species known to me have been included, and as many additional ones as possible. Species marked by an asterisk are unknown to me. In noting the position of the ocelli with respect to the bases of the antennae and the posterior margin of vertex, the head should be viewed from the side.

Females

1.—Apex of clypeus trilobed, the medial lobe largest and notched or toothed....2.
Apex of clypeus with a median tooth.....*australis* (Cockerell).
Clypeus largely impunctate and polished, its anterior margin crenulate; mandibles broad.....21.

Clypeus not much modified....3.

2.—Abdomen with much red; facial line considerably longer than transfacial. *timberlakei* Michener.

Abdomen black; facial line only a little longer than transfacial. *clypeodentata* Michener.

3.—Legs partly red, the abdomen black; desert species with much pale pubescence.4.

Legs black (or the tarsi sometimes reddish), or if abdomen is partly red, the legs may be partly red; pubescence usually less conspicuous....6.

4.—Legs entirely red except for the coxae; clypeus rather dull. *haematopoda* Cockerell.

Fore and middle legs partly suffused with black, the fore legs sometimes entirely black....5.

5.—Clypeus shining, with large punctures. *bigeloviae* (Cockerell) (= ? *rufipes* Titus).

Clypeus dullish, with smaller punctures....*rhodopus* Michener.

6.—Apex of clypeus broadly rounded, slightly crenulate, the apical margin very broadly somewhat shining; red present on abdomen, but not on legs. *howardi* Cockerell.

Apex of clypeus truncate, the truncation sometimes slightly concave or undulate....7.

7.—Punctures of apical part of clypeus very dense and small, this region distinctly duller than rest of clypeus; truncation of clypeus concave....8.

Apical part of clypeus not duller than the rest of clypeus, the extreme apical margin impunctate....9.

8.—Red on abdomen and hind legs....*basalis basalis* Michener.

Abdomen and hind legs black....*basalis nigra* Michener.

9.—Face unusually broad, the length of an eye being about equal to the greatest distance between the eyes; large robust form....*maxima* Michener.

Face not so broad, the length of an eye greater than distance between eyes; usually smaller or less robust species....10.

10.—Dorsum of head and thorax dull, finely and closely punctate. (*A. schwarzi* Titus, only 5 mm. long, is the dullest of the other group and the only one that might make confusion here.)....*echinocerei* Cockerell.

Dorsum of thorax shiny and more coarsely punctate....11.

11.—Supraclypeal area dull and finely punctate in contrast to front and clypeus. *floridana* (Robertson).

Supraclypeal area punctured in about the same way as clypeus or front....12.

12.—Small joints of tarsi ferruginous; abdominal bands pale yellowish; pubescence abundant....*leucozona* Cockerell.

Small joints of tarsi black, or the claw joints sometimes rufescent....13.

13.—Punctation of abdomen very fine and sparse, the punctures of dorsum of second tergite much smaller than those of scutum. [See also *A. prosopidis* (Cockerell) which is only 5 mm. long, and some specimens of *A. coloradensis* Cockerell.]....14.

Punctation of abdomen not very much finer than that of scutum. [I have one *A. californica californica* (Ashmead) which would best fall in this group.] 15.

14.—Clypeus with large punctures, usually separated by shiny ground.
californica florissantensis (Michener).
Clypeus with smaller, close punctures.... *californica californica* (Ashmead).
15.—Distance from anterior ocellus to posterior edge of vertex greater than distance from anterior ocellus to antennal sockets; coarsely punctate species; abdomen rather long and parallel sided; anterior margin of clypeus usually with a slight notch on each side of the middle. (See *A. coquilletti* Titus)..16.
Distance from anterior ocellus to posterior edge of vertex equal to or less than distance from anterior ocellus to antennal sockets; abdomen not usually so parallel sided; anterior margin of clypeus not so notched....17.
16.—Punctures of cheeks coarser than those of pleura..... *bucconis* (Say).
Punctures of cheeks finer and sparser than those of pleura.
denticulata (Cresson) [= *rotundiceps* (Cresson), *wislizeni* Cockerell].
17.—Robust large-headed form; twice distance from posterior ocelli to posterior edge of vertex considerably greater than distance from posterior ocelli to antennal sockets. (More robust and more finely punctate than *denticulata* or *bucconis*.)..... *coquilletti* Titus.
More slender species; twice distance from posterior ocelli to posterior edge of vertex about equal to distance from posterior ocelli to antennal sockets..18.
18.—Facial line considerably longer than transfacial; punctures of abdomen considerably smaller than those of thorax..... *prosopidis* (Cockerell).
Facial line but little (if any) longer than transfacial; punctures of abdomen less conspicuously smaller than those of thorax.....19.
19.—Head and thorax rather finely punctate, the abdomen but little more finely so; very small species..... *schwarzi* Titus.
Head and thorax more coarsely punctate, the contrast between punctation of thorax and abdomen more conspicuous.....20.
20.—Pleura quite finely and rather closely punctate, usually a little more finely so than cheeks; practically no spots of pubescence at anterior edge of scutum; abdomen sometimes partly red, usually more finely and sparsely punctate than in forms of *cactorum;* clypeus about as in *A. cactorum aridula.*
coloradensis Cockerell.
Pleura a little more coarsely punctate; inconspicuous spots of pubescence at anterior edge of scutum; clypeus moderately closely punctate, not strongly shiny..... *cactorum aridula* (Cockerell).
Pleura a little more coarsely punctate than in either of the above; clypeus above with rather large punctures, separated by shiny ground; anterior edge of scutum with a pair of well-developed hair-spots.
cactorum cactorum (Cockerell) (= *meliloti* Cockerell).
21.—Anterior margin of clypeus with a deep median emargination.
Titusella cubiceps (Cresson) (= *pronitens* Cockerell).
Anterior margin of clypeus without a deep emargination.
T. clypeata Michener.

MALES

1.—Abdomen black (sometimes brownish at extreme sides); legs partly red.....2.
Abdomen black (sometimes brownish at extreme sides); legs dark brown or black (or the tarsi sometimes reddish); or abdomen with red, the legs with or without red.....4.

2.—Legs entirely red; median apical teeth of abdomen more than twice as long as basal width..... *haematopoda* Cockerell.

For legs and middle legs beyond the femora black or suffused with black.....3.

3.—Median teeth at apex of abdomen nearly twice as long as basal width, black. *rhodopus* Michener.

Median teeth at apex of abdomen about one and one-half times as long as basal width or a little shorter, usually translucent. *bigeloviae* (Cockerell) (= ? *rufipes* Titus).

4.—Abdomen nearly all red..... **holti* Cockerell

Abdomen black or only partly red.....5.

5.—Lateral teeth at apex of abdomen very broad, the apex nearly a right angle, the lateral edges of sixth tergite strongly convex; abdomen with red.....6.

Lateral teeth at apex of abdomen narrower and acutely pointed, the sides of sixth tergite only slightly convex.....8.

6.—Hind femora black..... *howardi* Cockerell.

Hind femora with red.....7.

7.—Red markings bright; outer teeth at apex of abdomen red. *timberlakei* Michener.

Red markings very dark; outer teeth at apex of abdomen black; abdomen more finely punctate than in the above..... *lateralis* Michener.

8.—Abdomen with red.....9.

Abdomen black or nearly so.....10.

9.—Clypeus, except apically, with rather large punctures; bases of hind femora red; red of abdomen confined to first tergite and extreme sides of second. *basalis basalis* Michener.

Clypeus dull with minute close punctures; red variable, but so far as I have seen not as in *basalis*..... *coloradensis* Cockerell.

10.—Median apical teeth of abdomen long and usually slender apically, at least one and one-half times as long as basal width except in a few species where the bases of the teeth are broadened. (In *A. altadenae* Michener these teeth are broad for their entire length, but in the other species the apical parts of the teeth are narrow, rather parallel-sided, and the apices are subtruncate.).....11.

Median teeth of apex of abdomen short and rather broad, less than one and one-half times as long as basal width. (In this group these teeth may be triangular in outline and pointed at apices, or rather parallel-sided and subtruncate at apices, but in no case are they narrow with subparallel sides apically as in most of the above group.).....19.

11.—Median apical teeth of abdomen broad, separated at their apices by less than twice the apical width of one of them, small species. *altadenae* Michener.

Median apical teeth of abdomen narrow, separated at their apices by much more than twice the apical width of one of them.....12.

12.—Dorsum of second tergite much more finely punctate than scutum.....13.

Dorsum of second tergite not very much, if any, more finely punctate than scutum.....14.

13.—Clypeus shiny with large punctures; sides of second tergite with larger punctures..... *californica florissantensis* (Michener).

Clypeus duller with smaller punctures; sides of second tergite duller. *californica californica* (Ashmead).

14.—Punctures of dorsum of abdomen coarser than those of scutum; legs dark brown ..... *arizonensis* Michener.

Punctures of dorsum of second tergite the same size or smaller than those of scutum ..... 15.

15.—Length 7 mm. or more ..... 16.

Length less than 6 mm. ..... 18.

16.—Clypeus more coarsely punctate; slender species; facial line about equal to transfacial ..... *opuntiae* (Cockerell).

Clypeus more finely punctate; robust species; face wider ..... 17.

17.—Scutum rather shiny, its punctures like those of vertex.. *maxima* Michener.

Scutum a little duller, its punctures somewhat finer than those of vertex. *submaxima* Michener.

18.—Usually larger; tegulae usually black. *cactorum cactorum* (Cockerell) (= *meliloti* Cockerell).

Usually smaller; tegulae usually testaceous ..... *cactorum aridula* (Cockerell).

19.—Apical teeth of abdomen light clear red, the median ones short and broad; pubescence abundant; small joints of tarsi ferruginous. *leucozona* Cockerell.

Apical teeth of abdomen black or dark red; pubescence less abundant; small joints of tarsi black except sometimes for claw joints ..... 20.

20.—Twice distance from posterior ocelli to posterior edge of vertex considerably greater than distance from posterior ocelli to antennal sockets; coarsely punctate species ..... 21.

Twice distance from posterior ocelli to posterior edge of vertex hardly if any greater than distance from posterior ocelli to antennal sockets; more finely punctate ..... 22.

21.—Wings quite dusky; very coarsely punctate species ..... *bucconis* (Say).

Wings paler brownish gray; a little less coarsely punctate form. *denticulata* (Cresson) (= *rotundiceps* (Cresson), *wislizeni* Cockerell).

22.—Scutum dullish with small close punctures ..... *curriei* Titus.

Scutum shiny, with larger, well-separated, punctures ..... 23.

23.—Punctures of vertex coarser than those of scutum ..... 24.

Punctures of vertex about the same size as, or a very little smaller than, those of posterior part of scutum ..... 25.

24.—About 5 mm. long; median apical teeth separated by about twice the basal width of one of them ..... *basalis nigra* Michener.

About 8 mm. long; median apical teeth separated by about the basal width of one of them ..... *floridana* (Robertson).

25.—Punctures of anterior part of scutum very fine compared with those of vertex or rest of scutum; pubescence rather sparse ..... *cockerelli* Michener.

Punctures of anterior part of scutum but little finer than those of disk of scutum; pubescence rather abundant. (One abnormal *A. cactorum aridula* (Cockerell) would run to this point.) ..... *coloradensis* Cockerell.

The following apparently valid species have been described but are omitted from the keys:

microsoma Cockerell (Mexico)
digiticauda Cockerell (Mexico)
rhodognatha Cockerell (Mexico)
subangusta Cockerell (Mexico)
crassa Cockerell (Mexico). Mr. Timberlake states that Cockerell's California record of this species (1925) apparently refers to *californica* (Ashmead), although true *crassa* from Mexico is distinct.
male *schwarzi* Titus (Arizona and Mexico)
male *coquilletti* Titus (California)
female *curriei* Titus (British Columbia and Washington)
gillettei Titus (Colorado)
female *opuntiae* (Cockerell) (New Mexico and California)
bequaerti Cockerell (Yucatan)
lutzi (Cockerell) (Colorado). Described as *Chelostomopsis* but probably an *Ashmeadiella*.

MONUMETHA

Monumetha albifrons (Kirby)

Gull Lake, Mono County, California, July 11, 1934 (Mrs. J. E. Law); Crabtree Meadow, Tulare County, California, July 20, 1935 (Evans).

Monumetha maura (Cresson)

The eyes of the female diverge below, indicating that this is a *Monumetha*, not an *Osmia* as originally described. Unfortunately the male is unknown.

Altadena, California, May 12 to June 11, on *Godetia* and *Phacelia tanacetifolia;* Mill Creek, San Bernardino Mountains, California, May 30, 1931; Big Bear Lake, San Bernardino Mountains, California, July 26, 1934 (Michener). The last specimen chewed a piece of a leaf of a small herbaceous plant into a pulp and started to fly away with it. (See notes on *Osmia pellax* Sandhouse, Jour. Econ. Ent., XXVIII, August, 1935.)

ROBERTSONELLA

Robertsonella gleasoni Titus

Several specimens of both sexes from Fedor and from Lee County, Texas (Birkmann), are referable to this species. One male is large, as in *R. crataegina* Cockerell, which is evidently a synonym of *gleasoni*. The venation is variable, and cannot be used to separate the species.

ALCIDAMEA

Alcidamea producta Cresson

One male from Boulder, Colorado, June 14, 1933 (M. and H. James) has testaceous tegulae, like the Californian *A. grinnelli* Cockerell.

However, the punctures of the scutum are as in *producta*. Numerous other specimens of *producta* from the same locality and from other parts of Colorado are normal.

OSMIA

Osmia cobaltina Cresson and **Osmia bruneri** Cockerell

The distinctions pointed out in keys by Sandhouse (1924) and Cockerell (1928) to distinguish female *O. cobaltina* from *bruneri* will not hold. Those of Sandhouse hold usually, but a decidedly purplish female from Boulder, Colorado (Thompson), has the hair of clypeus as long as in most *bruneri*, and the lower part of face not purple. Prof. Cockerell's distinction, based on the color of the hair of the propodeum, is apparently an error. *O. cobaltina* usually has a few dark hairs on lower part of posterior face of propodum, while *bruneri* does not. If the series is divided by length of clypeal hairs, it divides nicely in one place. If the color of the scutum is used, the division point is in quite a different place. The hairs of the propodeum and the color of the abdomen are similarly unsatisfactory. On the basis of the females, then, I think *bruneri* is a variety of *O. cobaltina*.

The apparent difficulty lies in the males. A gynandromorphic specimen from Troublesome, Colorado (Rohwer), normal males from Gold Hill (M. T. James), Princeton Hot Springs (Chas. Wagner), Boulder, Ward, and Elbert (Lutz), all in Colorado, and Craters of the Moon, Idaho (Louise Ireland), are apparently *O. cobaltina* or *bruneri* (all are green). Yet a male supposed to be *O. cobaltina* from Mount Wilson, Los Angeles County, California (F. Grinnell, Jr.), is certainly a different species. I now believe that this specimen is the male of *O. kerminesina* Sandhouse. This specimen and the gynandromorph have made it entirely impossible to determine male *cobaltina* or *bruneri* from any key. It appears that the Mount Wilson specimen is the basis for male *cobaltina* in the Sandhouse keys, while the statement in Cockerell's key that male *bruneri* has the hair of vertex entirely black is based on the gynandromorph. Therefore I give notes on each species, as follows:

Osmia cobaltina Cresson

The male is *O. bella* Cresson.

Osmia cobaltina bruneri (Cockerell)

The male is *O. bennettae* Cockerell.

In the males, both forms are bright green. They do not differ structurally, unless the genitalia are found to be different. A male from

Ward, Colorado, bred by C. H. Hicks, from the same lot with a female *bruneri* has a few black hairs on the vertex, thus being somewhat intermediate between the two forms. The male *cobaltina* from Idaho, referred to above, has the posterior margins of the tergites purple.

Three female *Osmia* from Big Bear Lake and Bluff Lake, both in the San Bernardino Mountains, California, two on *Potentilla bolanderi* var. *bernardina*, July 15, 1935 (Michener), are apparently *O. cobaltina*, but the pubescence of the thorax is unusually short, perhaps due to wear.

Osmia kerminesina Sandhouse

MALE.—Rich purple, including tegulae and legs except the tarsi (hind basitarsi purple); the scutum slightly bluer; the face around antennae and at sides greenish blue; the abdomen rather reddish purple, the apical margins of the tergites concolorous. Pubescence black (that of pleura, cheeks, and fore legs a little reddish, or quite pale in certain lights), except that of face, vertex, and dorsum of thorax; hair of face white with black intermixed, especially around antennae and sides of face; vertex black-haired, except for a few pale hairs around posterior margin and ocelli; scutum and scutellum pale-haired, with some black intermixed, especially on scutellum. Sixth tergite with a very minute notch; seventh bidentate; scutum finely and closely punctate.

It is possible that this is *O. basilissa* Cockerell but, in the females which I have examined, the basal vein nearly meets the transverse median in *basilissa*, while in *kerminesina* the basal vein is a little based to the transverse median. On this character, the male falls with *kerminesina*. The chief difference between the two species, in the females, is the punctation of the scutum. The distinction used by Sandhouse, based on the color of the tegulae, does not hold, since all the specimens of *basilissa* seen by me (including one determined by Sandhouse) have the tegulae entirely metallic. *O. kerminesina* varies from purple to bluish green. *O. basilissa* varies from purple to bluish purple.

Osmia holochlora Cockerell

A male from Boulder, Colorado, at flowers of *Besseya plantaginea*, May 15, 1908 (Rohwer), is apparently this species. It is most readily distinguished from *cobaltina* Cresson by the large notch of the sixth tergite and the lack of dark hair on head and thorax. A female from Boulder, June 9, 1905 (W. P. Cockerell), is probably this form. It is brilliant green, bluer than the male, but not blue. It resembles *O. cobaltina bruneri* but the hair of the pleura is white (various shades of fuscous, nearly black to quite pale, in *cobaltina*); the abdomen is smoother; the clypeus, viewed from in front, has the truncation shorter than the distance from end of truncation to eye margin (in *cobaltiua*

the trucation is longer than the distance from its end to eye margin, if viewed from directly in front but, if seen from obliquely above, the truncation appears short as in *O. holochlora*). This is the specimen which Cockerell suggested might be *O. bella* female, but he later changed this opinion, referring it provisionally to *O. cobaltina.*

Osmia ribifloris biedermannii, new subspecies

FEMALE (type).—Similar to typical *O. ribifloris* but green, the clypeus sometimes somewhat bluish; pubescence mostly black, but somewhat mixed with and on lower part of face practically replaced by pale fuscous.

MALE.—Green, the same color as the female; pubescence similar to that of male *O. lignaria* Say. The two are easily distinguished, of course, by the greener color and green legs of *ribifloris.*

Altadena, California (type locality), February 2, 3, and 16, 1935, on *Buddleia* and *Cryptanthe;* Arroyo Seco, Los Angeles County, California, January 27, 1935, and Pasadena, California, March 13, 1931, on *Ribes* (all Michener, coll.). Seventeen specimens show no intergradations toward the blue New Mexican form. Titus named this *O. biedermannii,* from Arizona specimens, two of which I have seen in the Cockerell collection. However, he has never published the name and is no longer working on bees.

Osmia parallela, new species

MALE.—Length 11½ mm.; form slender; abdomen parallel-sided. Head and top of thorax rather dull green, pleura, propodeum, and first tergite bluer and a little more shiny, rest of abdomen steel blue and quite shiny, the apical margins of the tergites concolorous; mandibles black, both teeth pointed; apex of clypeus black, the edge minutely sinuate; antennae black; tegulae black, green at anterior ends, legs black, the fore and hind femora bluish, the tibiae hardly greenish, the claw joints of the tarsi rufescent. Punctation of head and top of thorax fine and dense; pleura more coarsely and sparsely punctate, shining between the punctures; scutellum more coarsely punctate, especially medially, than scutum; enclosure of propodeum dull, the upper half longitudinally striate. Hair of head and thorax long and dense, pale ochraceous; white on clypeus; mixed with black on cheeks and posterior part of pleura; replaced by black on sides of propodeum, and by pale fuscous on vertex; hair of mandibles mostly black; hair of middle and hind legs black; small joints of tarsi with appressed white pubescence; fore femora with fringes of long white hair posteriorly; fore tarsi with white hair, longer black ones being intermixed; fore tibiae black-haired, with white hairs intermixed; pubescence of abdomen black except for a few pale hairs on last tergite and long pale hairs on first tergite. Middle tarsi normal; hind basitarsi with a small tooth. Wings slightly grayish, the basal vein meeting the transverse median, second abscissa of cubital vein longer than fourth, both quite long. Sixth tergite of abdomen with a rather small but deep semicircular notch; seventh bidentate; venter of abdomen normal.

La Crescenta, California (type locality), on *Salvia mellifera*, April 20, 1935 (Michener); Eagle Rock Hills, Los Angeles County, on *Salvia mellifera*, April 14, 1933 (Michener); Aliso Canyon, Los Angeles County, California, May 10, 1933 (Michener). The latter locality is on the edge of the desert.

This is a more slender species than *O. integra* Cresson. It apparently is closest to *O. marginipennis* Cresson, *cyaneonitens* Cockerell and *viridior* Cockerell. It differs from the first and third (which are said to be the same) by lack of pale hair on the second and third tergites, and from the second by presence of black hair on cheeks and sides of thorax. Runs to *O. peridonea* Sandhouse in the Sandhouse key to western species, from which it differs by lack of a polished line on scutellum, etc. It is very similar to *O. pseudamala* Cockerell, but differs by the black flagellum, and by the short, entirely black hair of dorsum of second tergite, etc. Differs from *O. seneciophila* Cockerell by the same characters and the deeper notch of the sixth tergite.

Osmia brevior, new species

FEMALE.—Length nearly 9 mm. Dark blue, the hind margins of the tergites concolorous. Pubescence black, intermixed with a very little white on scutellum and postscutellum, more white on first tergite, and a very little on remaining tergites, particularly second; a tuft of pale hair behind wing bases; cheeks with a little fuscous hair below. (Here and there, there seem to be a few other white hairs, but this is due to reflections on coarse black bristles.) Clypeus normal, the anterior edge black; mandibles black, tridentate, with an additional small tooth between second and third teeth; antennae black; tegulae black, bluish at extreme anterior ends. Punctation fairly fine and close, but some ground area visible between punctures, especially on posterior part of scutum; scutellum with an ill-formed longitudinal median impunctate line; enclosure of propodeum dull and minutely roughened above, shiny below. Legs black, with black hair except on the first four metatarsi, where it is rufescent. Wings quite dark grayish brown, the basal vein just basad to the transverse median, second abscissa of cubital vein twice length of fourth. Apical impunctate margins of tergites very narrow, absent on first segment.

Altadena, California (type locality), on *Lotus scoparius*, June 11, 1933, and May 12, 1934 (Michener); Big Bear Lake, San Bernardino Mountains, California, July 16, 1934 (Michener); Claremont (Metz).

Runs out at 48 in the Sandhouse key to western species. Differs from *O. visenda* Sandhouse by the much darker tegulae. This species does not have such long hairs on the face as in *O. brevis* Cresson. It differs from *O. nanula* Cockerell by having fewer pale hairs on scutellum, from *O. tristella* Cockerell by presence of pale hair on scutellum, and from *O. cyanella* Cockerell by tuft of pale hairs behind wing bases.

Osmia cyanosoma Cockerell

Fairfax, Marin County, California, April 12, 1925 (C. L. Fox); Mill Creek, San Bernardino Mountains, California, May 30, 1931 (Michener); Boulder, Colorado, July 6, 1935 (Michener). The species is new to Colorado.

A male which probably belongs to this species is from La Crescenta, California, on *Salvia mellifera*, May 5, 1935 (Michener). It differs from *O. atriventris* Cresson by the black flagellum, from *O. aprilina atrovirens* Sandhouse by black legs, bluer color, and longer head. It runs to *O. aprilina* Cockerell in the Sandhouse key to Pacific Coast species. Differs from *O. wheeleri* Cockerell by dark legs, etc. It is described as follows:

Length nearly 7 mm. Dark blue green, the face greener; posterior edges of tergites blue, edged apically with purplish brown; legs, tegulae, antennae, and mandibles black; the hind femora very faintly bluish. Anterior edge of clypeus minutely and irregularly dentate, black; hind metatarsi toothed, mid-tarsi and antennae normal. Punctation of head and thorax fine, close on head, not quite so close on dorsum of thorax, especially sparse in center of scutum, quite coarse on scutellum, which has a rather poorly formed median, impunctate streak; enclosure of propodeum dull. Wings brownish, the basal vein hardly basad to the transverse median, the second abscissa of cubital vein distinctly longer than fourth. Hair of head and thorax very long and rather sparse, white on face below antennae, black with a little pale intermixed on vertex, mixed black and pale on cheeks and front; hair of thorax pale, with a faint ochraceous tinge, with numerous long dark hairs on dorsum; hair of mandibles black; hair of legs mixed black and white, the white exceeding or replacing black in many places; hair of first tergite pale, mixed with much black at sides, of second pale on basal half of disk, otherwise mostly dark; hair of rest of abdomen mostly black, a few apparently pale (pale in certain lights, at least) hairs intermixed. Sixth tergite with a small notch, seventh bidentate, but not so strongly bidentate as in many species, the teeth broad and not sharply pointed.

Osmia trevoris Cockerell, and its relatives

The females belonging to this species may be separated thus:

1.—Hair of sides of propodeum pale; hair of vertex largely pale. . . *giliarum* Cockerell.
Hair of sides of propodeum black . . . . . 2.
2.—Hair of vertex all black; scutum with a few black hairs . . . . . *trevoris* Cockerell.
Hair of vertex largely pale; of scutum all pale . . . . . *subtrevoris* Cockerell.

O. corkinsi Sandhouse would run to *subtrevoris* but the scutum is much more coarsely punctured, the hair of front is largely pale, etc.

These are mixed in Cockerell's key (1928). In the type of *subtrevoris* the vertex has white hair, mixed with some black. The same is true of *O. giliarum*. In the description of *giliarum* the sides of the propodeum are definitely stated to have white hair, not black as indicated in Cock-

erell's key. However, Prof. Cockerell later corrected this (1935). In the key referred to, specimens of *O. giliarum* are the basis of *brevis* (of Cockerell, not of Cresson). I have not seen authentic *O. trevoris*, but I believe my identification is correct. Localities for females are as follows:

Osmia trevoris Cockerell

Florissant, Colorado, June 31, 1908 (Rohwer); Garberville, Humboldt County, California, April 19, 1935 (Van Duzee).

Osmia trevoris variety **subtrevoris** (Cockerell)

Florissant, Colorado, as previously recorded by Prof. Cockerell; Elbert, Colorado, June 3, 1934 (Figgins); near Parker, Colorado, May 11, on *Pentstemon* (Figgins); Jackson, Wyoming, 6300 feet elevation, 43° 30′ N., 110° 46′ W. (Mrs. F. E. Lutz); Pasco, Washington, May 25, 1896.

Osmia trevoris variety **giliarum** (Cockerell)

Florissant, Colorado [recorded as *O. wilmattae* Cockerell variety *a* (1912)]; Tolland, Colorado (Robbins); Elbert, Colorado (as recorded by Cockerell); near Parker, Colorado, May 11, on *Pentstemon* (Figgins).

The color of the pubescence of the scutellum is probably not of value in this group. It may be that in a single individual this pubescence changes from ochraceous to white in the course of the lifetime. *O. seneciophila* Cockerell is apparently the male of *O. trevoris subtrevoris* (Cockerell). One male from the top of Las Vegas Range, New Mexico (Cockerell) has a little black hair on the pleura.

Osmia corkinsi Sandhouse

Boulder, Colorado, 5600 feet elevation, May 27–28, 1922 (F. E. Lutz); Camp Roosevelt, Yellowstone Park, Wyoming, July 14–17, 1923.

Osmia hendersoni Cockerell

Two from Mount Putnam, near Blackfoot, Idaho, July 26, 1934 (Louise Ireland), are nearly 9 mm. long. One has the hair of sides of propodeum white. In the other it is black, as described. Another specimen [the *O. wilmattae* Cockerell variety *b* (1912)] has white hair on sides of propodeum. The latter specimen has the black areas of typical *hendersoni* bluish in some lights, and is more slender than the Idaho specimens. Specimens having white hair on sides of propodeum run to *O. grindeliae* Cockerell in Cockerell's key (1928). In the latter species, the punctures of scutum are not quite as close as they could be, while

in *hendersoni* they are as close as possible over most of the surface. In all these *hendersoni* the basal vein is basad to the transverse median.

Osmia chalybea Smith

A female from Edna, Texas (Bishopp), and a male from Louisiana (Morrison) are in the Cockerell collection. The species is easily known by the very dark brown wings. The male had been determined by someone (not Prof. Cockerell) as *O. marginipennis* Cresson, and is the cause for the statement in Cockerell's key (1928) that *marginipennis* has blue legs. A specimen of *marginipennis* from Wawawai, Washington, April 24, 1909, (det. Sandhouse) has black legs as described by Cresson.

Osmia caulicola Cockerell

Hubbard Ranch, near Elbert, Colorado, on flowers of *Gilia calcarea*, June 3 (Figgins); Elbert, Colorado, 7400 feet elevation, June 9–11, 1922 (F. E. Lutz); Stewart Ranger Station, Wyoming, 6700 feet elevation, 43° 42′ N., 110° 45′ W. (Mrs. F. E. Lutz).

The female runs to *O. phaceliae* Cockerell in Cockerell's table (1928). It differs from that species by the more coarsely punctate abdomen, which is short and globose. The pubescence of the two species is quite similar. *O. caulicola* has more black hair on the scutum than one would judge from the description. The pale pubescence of the above recorded specimens is nearly white, not ochraceous as in the types, which were bred specimens. In all the females (including the type) the hind femora are faintly greenish, not black as described. A male from Wyoming is bluer than the cotype male, and has more brown on the under side of the flagellum. The channel down the front in the female is a variable character. It is present in some specimens of both *O. phaceliae* and *O. caulicola*. *O. caulicola* resembles *O. liogastra* Cockerell, but in the latter species the clypeus is pale-haired.

Osmia brevis Cresson

Jim Creek, near Boulder, Colorado, 6400 feet elevation, June 21–23, 1922 (F. E. Lutz, at blue *Pentstemon*); Ward, Colorado, 9000 feet elevation, July 3, 1922 (G. W. Strawbridge); Claremont, California (Metz); Pasadena, California (Michener), April 1, 1931, and May 12, 1934, the latter on *Pentstemon spectabilis;* Eagle Rock Hills, Los Angeles County, California, May 27, 1933 (Michener), on *Lotus scoparius;* Gull Lake, Mono County, California, July 11, 1934 (Mrs. J. E. Law).

Osmia cerasi Cockerell

Roggen, Colorado, May 8, 1934.

Osmia nassa Cockerell

Claremont, California (Metz); San Gabriel Canyon, Los Angeles County, California, June 17, 1933 (Michener); Big Bear Lake, San Bernardino County, California, July 15, 1934 (Michener).

Osmia clarescens Cockerell

Claremont, California (Metz). This is a common species in Pasadena, California. Dates range from March 3 to April 29. I also have the species from La Crescenta, from Altadena, and from Puddingstone Canyon in the San Jose Hills, all in Los Angeles County, California (all Michener, coll.).

Osmia wardiana Cockerell

Longs Peak, Colorado, about 9000 feet elevation, June 14–19, 1922 (F. B. Lutz).

Osmia pentstemonis Cockerell

Mineral King, Tulare County, California, September 3, 1933, on *Aster* (Michener); Ward, Colorado, 9000 to 9300 feet elevation, June 3 and June 25, 1922 (F. E. Lutz); Elbert, Colorado, 7400 feet elevation, June 9–11, 1922 (F. E. Lutz). One male has the antennae slightly brownish beneath.

Osmia armaticeps Cresson

Ward, Colorado, 9300 feet elevation, June 25, 1922 (F. E. Lutz and F. B. Lutz, at dandelion).

The male *O. armaticeps* of Cockerell's key (1928) is evidently *O. amala* Cockerell. It differs from typical *amala* by the faintly greenish hind femora, but the difference is so slight as to be negligible.

Another male in the Cockerell collection labeled *O. armaticeps* is similar to *O. cyaneonitens* Cockerell but the seventh tergite is produced with a narrow notch. Perhaps this is another species, and *cyaneonitens* is the male *armaticeps*.

Osmia cyaneonitens Cockerell

Jim Creek, near Boulder, Colorado, about 6400 feet elevation, June 21–23, 1922 (F. E. Lutz, at blue *Pentstemon*).

Osmia besseyae Cockerell

Ward, Colorado, 9300 feet elevation, June 25, 1922 (F. E. Lutz); Longs Peak Inn, Colorado, 9000 feet elevation, June 15, 1922 (F. E. Lutz). These are about $6^1/_2$ mm. long.

Osmia coloradella Cockerell

Boulder, Colorado, 5500 feet elevation, May 24–25, 1922 (F. E. Lutz, at a legume and at *Pentstemon*). One of these is 11 mm. long, and hence runs to *O. densa* Cresson in Cockerell's key (1928).

Osmia longula Cresson

Ward, Colorado, 9300 feet elevation, June 25, 1922 (F. E. Lutz); east of Parker, Colorado, on *Pentstemon*, June 9 (Figgins). A specimen from the latter locality has a little green at the anterior end of tegulae.

Osmia albolateralis Cockerell

Boulder, Colorado, June (Norma LeVeque). This and a specimen from Eldora, Colorado (Cockerell), have the abdomen much bluer than in the type. The type has a few black hairs on front, scutum, and scutellum, very few on scutum. These were not mentioned in the original description.

Osmia lutzi, new species

FEMALE.—Length nearly 9 mm.; dark blue-green, the posterior edges of tergites concolorous and only very narrowly impunctate, the scutum dull in some lights, the clypeus and pleura blackish; antennae, mandibles, tegulae, and legs black, the tegulae with a brown spot; mandibles tridentate, with no indication of a fourth tooth; anterior margin of clypeus slightly emarginate; head and thorax finely and closely punctate, the scutum, except posteriorly, very finely punctate; scutellum with a polished streak; pubescence of head and thorax pale, the clypeus with much black hair, the vertex with much black intermixed, the rest of face and cheeks with some black intermixed; scutum with a very few dark hairs, easily overlooked; pubescence of legs black except for that of fore femora, which is largely white, and that of under sides of tarsi, which is rufescent or fulvous; wings brownish, the basal vein slightly distad to the transverse cubital, the second abscissa of cubital vein longer than fourth; pubescence of abdomen predominently black, but hairs of first tergite all white; second, third, and fourth tergites with white hairs at apices, second with some pale hair at base; sixth tergite with appressed pale hairs among the black; scopa black.

Jackson, Wyoming, July 13–17, 1920, about 43°, 30′ N., 110° 16′ W., elevation 6300 feet (Mrs. F. E. Lutz).

This species is related to *O. pellax* Sandhouse; but there is much less black hair in *O. lutzi*. The apical impunctate edges of the tergites are broad in *pellax*, almost wanting in *lutzi*. Otherwise the two species are very similar in structure. Another species with a very finely punctate scutum is *O. sedula* Sandhouse, which has quadridentate mandibles. *O. mertensiae* Cockerell also has quadridentate mandibles.

Osmia pellax Sandhouse

Gull Lake, Mono County, California, July 11, 1934 (Mrs. J. E. Law).

Osmia coloradensis Cresson

MALE.—Length 8½ to 9 mm.; blue to greenish blue, similar to the female; clypeus normal; antennae black; tegulae blue in front, black behind; fore and hind femora blue; hind tibiae sometimes very faintly metallic; hind metatarsus with a large tooth within; sixth tergite with a shallow notch, seventh bidentate; posterior margins of tergites slightly bluer (less green) than rest of abdomen; entire body rather finely and densely punctate, the scutellum without an impunctate streak; enclosure of propodeum shiny below, dull and rough above; stipites with few short hairs.

Runs to *O. eutrichosa* Cockerell in the Sandhouse keys (1924 and 1925) and to *O. ramaleyi* Cockerell in Cockerell's key (1928).

The hind femora of the female are sometimes faintly metallic, more often black. The females vary from blue to blue-green, and in one specimen the scutum is blackish in many lights.

California: Florence Lake, Fresno County, July, 1931; Tokopah Valley, Sequoia National Park, August 25, 1933, on *Rudbeckia californica;* Pasadena, March 17 to May 1; San Diego, April 1, 1934 (all Michener, collector).

Osmia (Acanthosmioides) nifoata Cockerell

I have seen a cotype of this species, and another specimen from Fox Park, Wyoming, 9100 feet elevation, 41° 4′ N., 106° 9′ W., June 15, 1920 (F. E. Lutz). The distinctions noted by Sandhouse to distinguish *O. nifoata* from *O. sladeni* Sandhouse (of which I have seen a paratype) do not hold. There are a few black hairs on the cheeks of both specimens of *nifoata.* The basal vein meets the transverse median in *sladeni* and in the Wyoming *nifoata,* and is only slightly basad to it in the cotype of *nifoata.*

The hind tibiae are greenish except on apical third in the cotype of *nifoata,* black in the Wyoming specimen. In both *nifoata* and *sladeni* the process of the second sternite is compressed apically, not much widened basally (seen from beneath), with a groove on ventral side. This is doubtless similar to that found in *O. odontogaster* Cockerell.

Osmia (Acanthosmioides) physariae Cockerell

One specimen (det. Sandhouse) with same data as the Wyoming *O. nifoata* recorded above. This will run to *nifoata* in Cockerell's key (1928). Perhaps this is incorrectly determined. The fore and hind femora are bluish (described as black); the basal vein is a little distad to the transverse median (description says they meet). Also, the

description makes no mention of a process on the second sternite. However, it is probable that Miss Sandhouse has seen the type and that this specimen is correctly determined. The process of the second sternite is small, somewhat compressed apically, when seen from beneath pointed at apex and much widened basally.

Osmia (Acanthosmioides) wyomingensis, new species

MALE.—Length nearly 8 mm. Blue, the front greenish, the vertex and dorsum of thorax blackish in many lights, the enclosure of propodeum purplish, the apical tergites greenish, the sides of first tergite brownish, the apical margins of tergites brown; flagellum crenulate, brownish red beneath; legs black, the fore and hind femora faintly bluish, the claw joints of tarsi reddish; mandibles black; tegulae black with a large brown spot occupying most of posterior part, the anterior ends blue. Wings quite clear, the basal vein meeting the transverse median, the second abscissa of cubital vein twice as long as fourth. Scutellum more coarsely punctate than scutum, without a median polished streak. Hind metatarsus broad at apex, tapering toward the base. Pubescence of head and thorax very dense, that of abdomen not so dense; pubescence of head and thorax whitish, the cheeks with a few dark hairs, the posterior part of pleura and sides and posterior face of propodeum with some black hairs, especially on propodeum; pubescence of clypeus of the usual erect dense type of this subgenus, but that of rest of face sparse, perhaps because of wear; pubescence white on dorsum of first two tergites, black at the sides of the second; third tergite with pale pubescence, mixed with black on posterior part of dorsum and replaced by black laterally; remaining tergites black-haired except for some pale hairs on dorsum of fourth; sternites with the pubescence largely black. Apex of abdomen as usual for the subgenus, the teeth of seventh tergite obtusely pointed; process of second sternite thick, closely appressed to the surface of abdomen, not very long, the base somewhat broadened (seen from beneath), the ventral edge convex, not grooved [superficially, when seen from the side, it looks like the process of the second sternite of *Alcidamea simplex* (Cresson), although in that species it is a tubercle on the disk of the sternite, while in the *Osmia* it is on the apical edge of the sternite, overhanging the third sternite].

Jackson, Wyoming, 6300 feet elevation, 43° 30′ N., 110° 46′ W., July 13–17, 1920 (Mrs. F. E. Lutz).

The process of the second sternite distinguishes this species at once from all previously described forms. I give a key to males of the subgenus *Acanthosmioides*. This is one of the most distinct groups of *Osmia*, but it easily falls within *Osmia*, as separated from *Chlorosmia* and other genera. Species marked by a (*) are known to me only by the descriptions.

1.—Flagellum pale testaceous, except for a black tip to the flattened last joint. (*O. watsoni* Cockerell has similar antennae but is not an *Acanthosmioides*.) **ashmeadii* (Titus).

Flagellum black above, dusky or brown below.....2.

2.—Posterior part of abdomen with pubescence largely black.....3.
Posterior part of abdomen with pubescence largely pale.....5.
3.—Process of second sternite thick and heavy, appressed to surface of abdomen, its ventral edge convex; posterior margins of tergites purplish brown. *wyomingensis* Michener.
Process of second sternite standing out from ventral surface of abdomen, the apex thin, laterally flattened, the ventral edge concave until the compressed apical part (which is rounded when seen in profile) is reached.....4.
4.—Robust greenish species; wings dusky.....*sladeni* Sandhouse.
More slender blue species; wings quite clear.....*nifoata* Cockerell.
5.—Process of second sternite with a small hook at tip.....6.
Process of second sternite not hooked at tip.....7.
6.—Length 10 mm.....*uncinata* Michener.
Length 15 mm.....**vanduzeei* Sandhouse.
7.—Pubescence of abdomen ochraceous at base and apex, short and fuscous on tergites two to four and base of five; process of second sternite probably similar to that of *O. nifoata*.....**odontogaster* Cockerell.
Pubescence of abdomen entirely pale; process of second sternite small, when seen from beneath wide at base and pointed at apex; length 10 mm.; differs from all other species known to me by the hind basitarsus, which tapers toward the apex, instead of toward the base.....*physariae* Cockerell.
Pubescence of abdomen very short and sparse, probably worn off, but apparently all pale; process of second sternite small, viewed from beneath wide at base and pointed at apex; differs from *physariae* by opaque blackish scutum and vertex.....*erecta* Michener.

CHLOROSMIA

The genus *Chlorosmia* was named by Sladen, to include certain brilliantly green, slender species. It has usually been considered as a subgenus of *Osmia*, but it seems to me to be at least as distinct as such forms as *Alcidamea* and *Monumetha*. *Chlorosmia* is characterized by its large stigma (for the group); deep sulcus, without a carina above it, on the first tergite; sixth and seventh tergites of the male unnotched, the sixth with lateral teeth, the seventh much exposed, somewhat excavated above; form very slender; notauli linear; scopa of female black; coloration bright blue or green. The following key separates *Chlorosmia* from its relatives:

1.—First tergite with a broad impunctate concavity, bounded by a strong carina. *Ashmeadiella.*
First tergite with a sulcus, and a fine, though distinct, carina separating the dorsum from the anterior face of the tergite; area in front of the carina nearly impunctate, in contrast to that behind it.....*Osmia.*
First tergite with a narrow sulcus, but no carina, the dorsal and anterior parts of the tergite not punctured in distinctly different ways.....2.
2.—Brilliantly metallic.....*Chlorosmia.*
Black.....*Hoplitina, Proteriades, Hoplitis, Alcidamea, Monumetha, Andronicus.*

I give a key to the species of *Chlorosmia*. I have seen all the species except female *C. viridimicans* (Cockerell).

MALES

1.—Large species. Antennae dilated, the scape very large, the flagellum broadened, especially near sixth segment (of flagellum), the ninth and following segments comparatively slender, the apical segment most slender, curved, and somewhat excavated beneath. Hair of abdomen largely black. Last visible tergite subtruncate, the truncation armed medianly with a stout spine; second sternite with a long slender median spine on the apical margin. *viridimicans* (Cockerell).

Smaller species. Antennae normal. Pubescence all pale. Seventh tergite not so modified; second sternite with a small median tooth on apical margin..2.

2.—Seventh tergite broadly snout-like at apex, a portion of each lateral margin concave; apex of third sternite broadly truncated, the middle of truncation slightly convex, with a minute tooth. Tegulae green, a spot on posterior part shining black.....*fulgida* (Cresson).

Seventh tergite broadly rounded, the margin convex throughout; third sternite without a median tooth on apical edge.....3.

3.—Third sternite broadly rounded behind. Tegulae entirely green. Second abscissa of cubital vein shorter than fourth; abdomen and hind legs strongly green, vertex and scutellum sometimes golden; length $8^1/_2$ to 9 mm. *lawae* Michener.

Third sternite truncated behind, slightly emarginate in the middle. Tegulae green, or black posteriorly. Second abscissa of cubital vein somewhat shorter than, or a little longer, than fourth; length $8^1/_2$ to 10 mm. *platyura* (Cockerell).

FEMALES

1.—First recurrent vein meeting or nearly meeting first transverse cubital. Pubescence black. Length 12 to 14 mm.....**viridimicans* (Cockerell).

First recurrent vein far beyond first transverse cubital. Length 11 mm. or less..2.

2.—Tegulae practically all green. Pubescence all black, somewhat dilute and reddish on dorsum of head and thorax; scopa not in the least reddish. Venation as noted for male.....*lawae* Michener.

Posterior third of tegulae black. Pubescence rather dark to pale fuscous; the scopa rather reddish.....*platyura* (Cockerell).

Posterior two-thirds of tegulae black. Pubescence pale to dark fuscous, frequently reddish; apical part of scopa usually reddish. Size usually larger than in *lawae* or *platyura*.....*fulgida* (Cresson).

The females of this group are difficult to identify, and, in view of the variability of male *C. platyura*, I suspect that some of the characters noted above for the separation of the females will break down.

Chlorosmia lawae, new species

Agrees with the description of *C. platyura* except as indicated above. The females are bluish but, as usual, variable. The male is the type.

Gull Lake, Mono County, California (type locality), July 11, 1934 (Mrs. J. E. Law); Altadena, California, April 18 and May 11, 1935, on *Phacelia tanacetifolia* (Michener); Aliso Canyon, Los Angeles County, California, May 3, 1931 (Michener).

Chlorosmia platyura (Cockerell)

Pasadena, California, April 10, 1933 (Michener); Altadena, California, May 11, 1935, on *Phacelia tanacetifolia* (Michener). There seem to be all intergradations between the two extremes noted in the key to the males.

Chlorosmia fulgida (Cresson)

Ward, Colorado, 9300 feet elevation, June 25, 1922 (F. E. Lutz, at dandelion); Boulder, Colorado, June 6 and 27, 1922 (F. B. Lutz, G. W. Strawbridge); Elbert, Colorado, 7400 feet elevation, June 9–11, 1922 (F. E. Lutz, at *Rubus deliciosus*); Leadville, Colorado, 10,000 to 11,000 feet elevation, July 7–14, 1896 (H. F. Wickham). The females vary from golden green [*C. viridis* (Cresson)] to blue. All males are green. Can the *fulgida* recorded by Sandhouse from California be *lawae* or *platyura?* Only females were recorded.

Chlorosmia viridimicans (Cockerell)

Fallen Leaf Lake, Lake Tahoe, California (Van Dyke) (determined by Sandhouse).

In addition to the characters mentioned in the key, the following are noted for the male: pubescence of head and thorax entirely pale, of abdomen pale on first tergite, somewhat mixed on second, and black beyond; hair of sternites black.

This is an aberrant species, and might well form the type of a new subgenus or genus. The last segment of the male flagellum is somewhat like *Alcidamea*, while on the whole the flagellum reminds one of *Andronicus*. The antennae are much more strongly modified than in *Monumetha*.

Chelynia pavonina Cockerell

Ward, Colorado, about 9300 feet elevation, June 25, 1922 (F. E. Lutz, at dandelion).